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WOODS HOLE OCEANOGRAPHIC INSTITUTION MASS
RESEARCH IN RELATIONS BETWEEN THE NORTH ATLANTIC SEA ICE AND AR--ETC(U)
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WOODS HOLE OCEANOGRAPHIC INSTITUTION

Woods Hole, Massachusetts

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Reference No. 49-41

(6) Research in Relations between
the North Atlantic Sea Ice and
Arctic Weather.

conducted during the period
May 15, 1949 - August 15, 1949

(9) Rept. for 15 May-15 Aug 49.

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Periodic Status Report
Submitted to the Office of Naval Research
Under Contract No. N6onr-277
Task Order No. 5.

(11) Sept 1949

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Director

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According to the terms of Contract N6onr-277,
Task Order No. 5, the work to be performed by the Con-
tractor shall consist of the following:

1. Select monthly and seasonal ice data beginning approximately with this century, prepared by the Danish Meteorological Institute and the International Ice Patrol, and which were treated for individual regions in a recent investigation by L. Koch (9, Koch, 1945).
2. From the available historical series of the mean monthly northern hemisphere sea-level and regional upper-air pressure charts, and also from the seasonal charts which are to be prepared, compute zonal, meridional, and other significant indices of the large-scale atmospheric circulation contemporary with and preceding various ice conditions in the several regions investigated.
3. Prepare mean monthly and seasonal series of North Atlantic sea temperatures from data collected by the International Council for the Exploration of the Sea and the Hydrographic Offices of the United States and British Navies.
4. Compute mean monthly and seasonal series of water transports in regions that have possible bearings on the ice conditions.
5. Obtain from the wind velocities to be derived from the mean monthly and seasonal sea-level pressure charts estimates of the water-transport in the trade and other North Atlantic areas for which no direct determinations can be had.
6. Develop methods for estimating the extent and mechanism of ice melting and young-ice formation.
7. Investigate possible relations between the critically evaluated dynamic and thermal circulation indices and contemporary and following ice conditions.

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ABSTRACT
The program of research in relations between North Atlantic ice and Arctic weather was begun by Mr. Irving Schell with separate considerations for the two distinct types of sea ice, icebergs and pack or field ice, and the oceanographic and meteorological factors that to a great extent control their movements and distribution.

ABSTRACT
Icebergs

The correlation tests currently being made are based on data of berg counts from 1880 to 1949 (Fig. 1) and pressures etc. from southern Greenland, Iceland, northern Europe and eastern Canada covering, as far as possible, the same seventy years of record. The earlier part of this record has been studied by Smith (1931) and the factors used in his forecasting technique are being tested for their stability in the hope that some of them might prove little affected by longer-period trends in the circulation and could hence be safely retained in their present capacity and, furthermore, might point to a broader approach to the problem of iceberg forecasting.

Tests are also being conducted on the possible effect of the pressure to the west of Greenland on the drift of the bergs on the west side of Baffin Bay and Davis Strait (Walker, 1947) from where they eventually

reach south of Newfoundland.

Also, data of the temperature, volume and transport of the Labrador Current obtained in recent years by the U. S. Coast Guard (Soule, 1940, and in preparation for publication) are being compared with different factors as well as with the berg counts to determine, if possible, a relationship between them.

Pack or field ice

Data of the ice off Iceland (first of regions to be investigated) that were recently critically re-examined by Koch (1945) (see Fig. 2 and Table I) have been compared for the period 1831-1940 with the mean annual temperatures by decade in the North Atlantic-Arctic (Stykkisholm and Archangel), northern Europe (exclusive of Archangel) and New Haven, (U.S.A.).

The results indicate a marked relationship of the ice with the temperature of Iceland and Archangel (Table I), but little direct relationship with the temperatures of northern Europe as a whole and northeastern U.S.A. (Table II).

Also, mean monthly pressure differences between selected points in the North Atlantic have been computed for a possible derivation of circulation indices that later, it is hoped, will be compared with the ice.

Work to date includes investigations under sub-sections 1, 2, 3, 4 and 7 of the Contract (see first page). The consideration of sub-section 5 has been deferred pending the comparison of theoretically derived wind velocities with those observed at island stations. In the case of sub-section 6, no plans have yet been formulated.

References

Smith, E. H. (1931), The Marion Expedition to Davis Strait and Baffin Bay. 1928. U.S. Coast Guard Bull. No. 19, Part III, pp. 1-221.

Soule, F. M. (1940), Physical Oceanography, the Grand Banks Region and the Labrador Sea in 1940. U.S. Coast Guard Bull. No. 30, pp. 36-56.

Walker, G. T. (1947), Arctic Conditions and World Weather. Q. J. R. Met. Soc. V. 73, pp. 226-256.

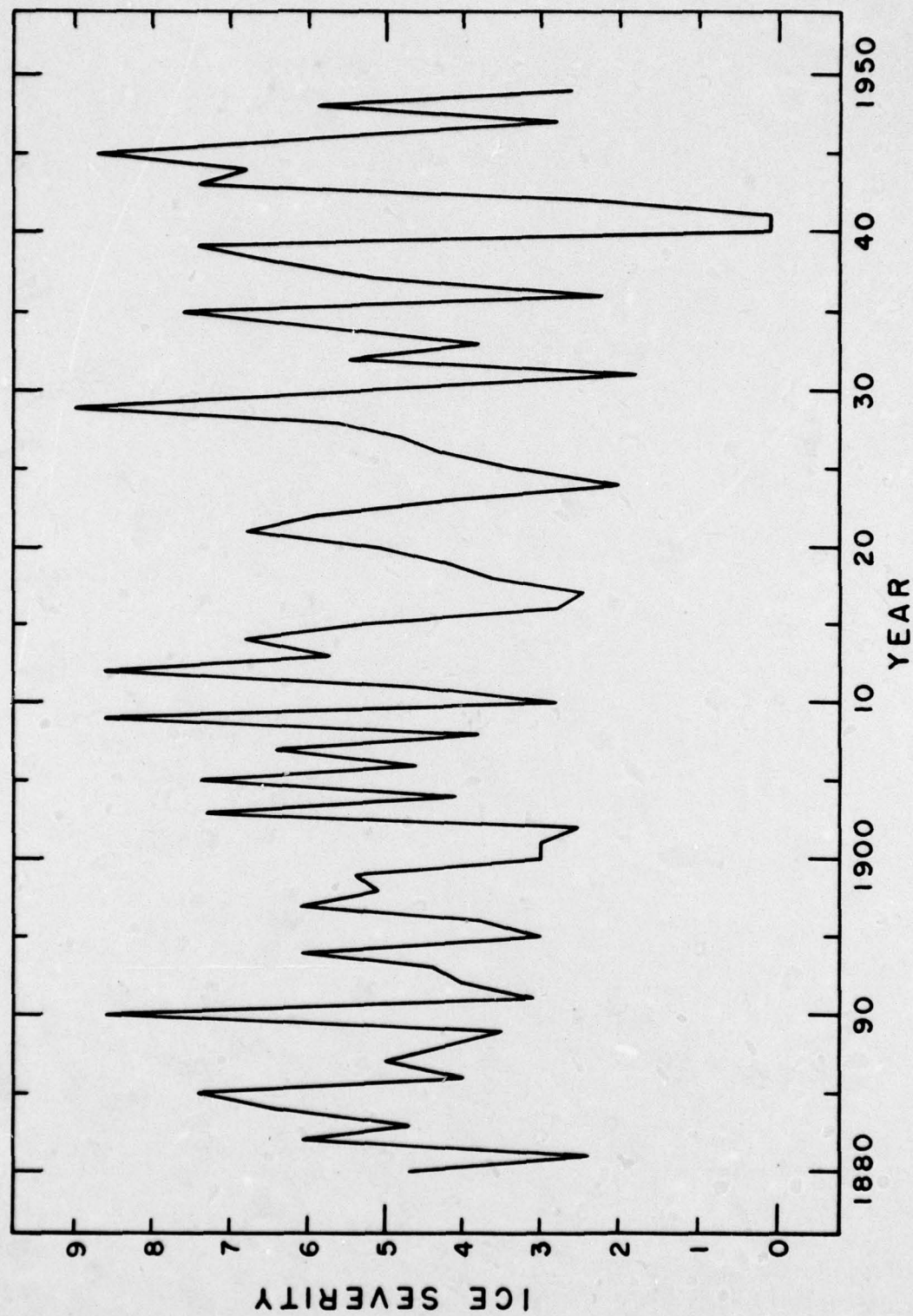


FIG.1 ICEBERG COUNTS SOUTH OF NEWFOUNDLAND (LAT. 48°N) ON A SCALE OF 10, DURING 1880-1949, BASED ON REPORTS FROM THE INTERNATIONAL ICE PATROL.

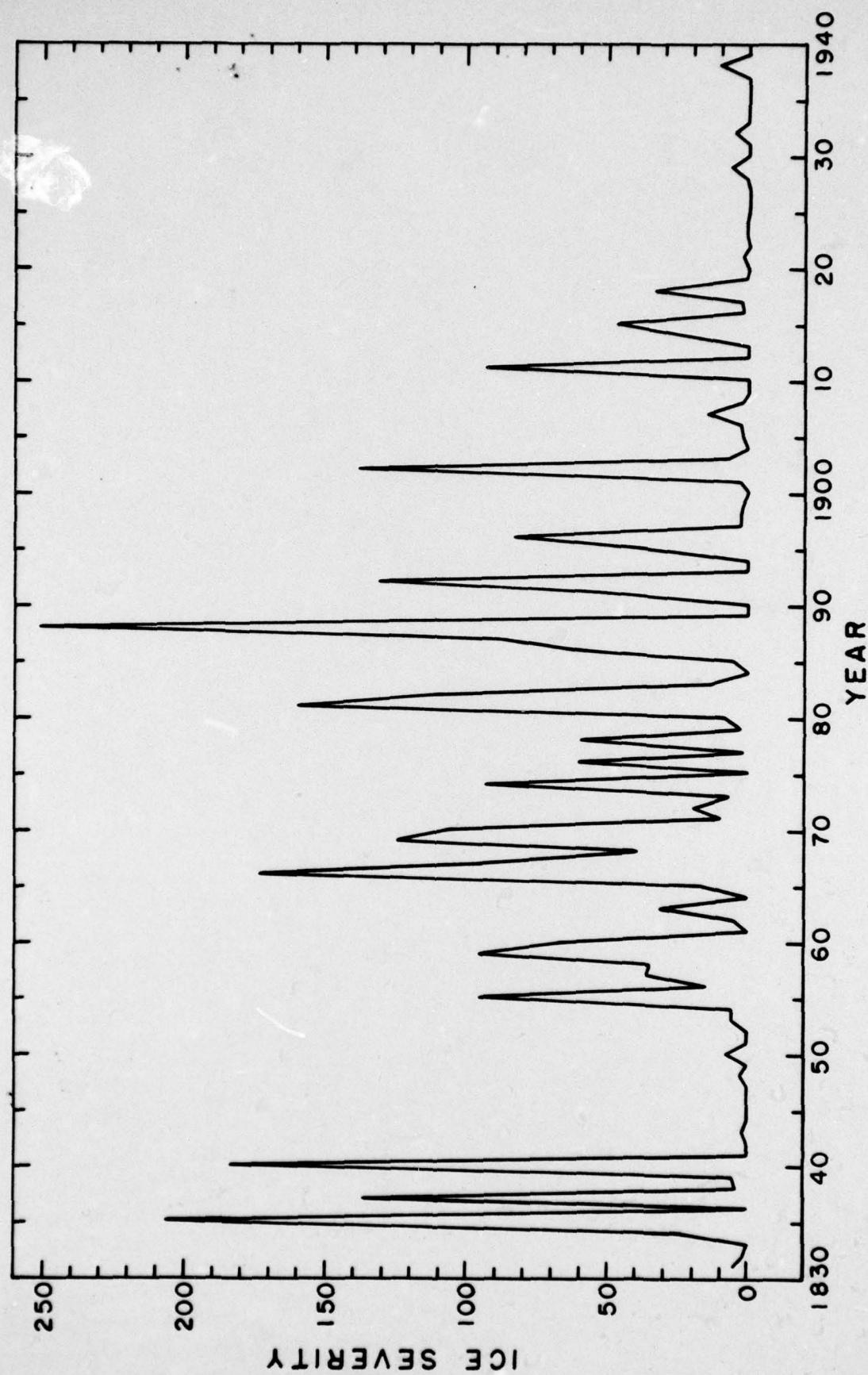


FIG.2 ESTIMATES OF ANNUAL ICE SEVERITY OFF ICELAND GIVEN BY THE
NUMBER OF WEEKS MULTIPLIED BY THE NUMBER OF AREAS WITH ICE
AROUND ICELAND EACH YEAR DURING 1831-1940 (AFTER: LAUGE KOCH).

TABLE I

Estimated Mean Annual Ice Severity off Iceland
by Decade, 1831-1940 (After Lauge Koch, 1945)
Compared with Mean Annual Temperature
Deviations at Stykkisholm and Archangel

Decade	Ice Units	Type	Stykkish. °C.	Arch. °C.
1831-40	<u>56.7</u>	<u>Severe</u>	-	<u>-.47</u>
-50	<u>0.9</u>	<u>Light</u>	*0.43	<u>.35</u>
-60	35.3	Moderate	-0.22	.18
-70	<u>59.7</u>	<u>Severe</u>	<u>-0.58</u>	<u>-.36</u>
-80	26.5	Moderate	-0.13	-.71
-90	<u>69.4</u>	<u>Severe</u>	<u>-0.53</u>	<u>-.30</u>
-1900	30.9	Moderate	-0.12	-.68
1901-10	17.1	Moderate	-0.12	.01
-20	20.7	Moderate	-0.20	-.11
-30	<u>1.2</u>	<u>Light</u>	<u>0.65</u>	<u>.65</u>
-40	<u>1.8</u>	<u>Light</u>	<u>1.09</u>	<u>1.41</u>
Average	29.1			

* No data until 1846.

TABLE II

Severity of Ice off Iceland and Mean Annual Temperature Deviation from Long-Term Average in Northern Europe and New Haven, (U.S.A.) by Decade during 1831-1940.

Decade	Ice Severity	Northern Europe* °C.	New Haven °C.
1831-40	<u>Severe</u>	<u>-0.41</u>	<u>-0.53</u>
-50	<u>Light</u>	<u>-0.24</u>	<u>-0.04</u>
-60	Moderate	-0.13	-0.48
-70	<u>Severe</u>	<u>-0.42</u>	<u>-0.33</u>
-80	Moderate	-0.34	0.35
-90	<u>Severe</u>	<u>-0.10</u>	<u>-0.41</u>
-1900	Moderate	0.01	-0.06
1901-10	Moderate	0.10	-0.05
-20	Moderate	0.21	0.38
-30	<u>Light</u>	<u>0.27</u>	<u>0.59</u>
-40	<u>Light</u>	<u>0.98</u>	<u>0.86</u>

* Mean of nine stations north of 55°N (Vardo, Bergen, Edinburgh, Oslo, Copenhagen, Stockholm, Helsinki, Leningrad, Moscow).